TAKING COMMAND — TOWARD IMPROVING COMMAND AND CONTROL

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PREFACE

This paper describes some of the challenges faced by the Air Force in recent contingencies, and the demand placed on theater command and control forces to meet these challenges. The purpose of this paper is threefold: First, to describe (in brief) the organization and functions of the command and control *force element* supporting the Air Force component commander. Second, to capture in one place comments and criticisms from senior commanders and top DoD officials regarding the ability to command and control airpower in recent operations. Because command and control forces exist to support senior commanders and provide information to top DoD officials, these viewpoints and reflections are important. The third and final purpose of this paper is to derive from the expressed viewpoints the new capabilities that our theater command and control forces should have. We discuss the implications of providing and updating these capabilities on the process of developing the personnel, systems, and process that will constitute our theater command and control forces.

The authors have relied throughout the course of this research on interviews with senior Air Force officers, their written comments, and official DoD documents. More research is needed on this topic to provide detailed advice to those with the difficult task of translating user needs into capable, functioning systems and forces.

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1. INTRODUCTION

A well-trained and well-equipped Air Force has given the U.S. military important advantages in combat. These advantages include the speed with which the United States can strike an enemy, the range of enemy forces and facilities that the United States can hold at risk, and the weight of effort that the United States can apply against these targets. Aerospace power was decisive in the Persian Gulf War and virtually the only force applied in Kosovo. The U.S. Air Force provided the bulk of the aerospace contribution in each of these coalition operations.

Although successful, the U.S. Air Force has faced significant difficulties in recent operations. U.S. forces have been called into action around the globe, on short timelines and in contingencies that allowed neither adequate training nor planning. The Air Operations Centers (AOCs) providing the Air Force theater command and control have been built on the fly as forces are deployed to each contingency. The result is that our air forces have been deployed in the most recent operations without well-established theater AOCs to maximize their combat effectiveness.

At the same time, adversaries have found clever ways to limit the effectiveness of U.S. air forces in accomplishing selected military tasks. Enemies have been careful to limit the exposure of some key forces to attack by employing them sparingly and by making maximum use of camouflage and deception. In future conflicts, enemies will try to limit access to the theater to delay the entry of U.S. forces and to raise the risk of casualties. In addition, enemies will try to increase the speed of their attacks - hoping to accomplish their objectives before U.S. forces can arrive in useful numbers.

To overcome these challenges, the Joint Force Commander needs the ability to strike enemy offensive forces early in a conflict - while U.S. forces deploy to theater – and to strike whatever defensive forces the enemy uses to complicate U.S. operations. The Air Force is improving surveillance, reconnaissance, and strike forces to better find

and attack a sophisticated enemy. The Air Force needs to improve the command and control of its forces as well.

In Korea, air forces are commanded and controlled from a well-established operations center, manned by personnel that train and exercise daily[1]. Ongoing Northern Watch and Southern Watch Operations in Southwest Asia (SWA) are handled by two COACs - one in Turkey and the other in Saudi Arabia. However, these CAOCs and some other AOCs are not manned to control forces in major conflicts (e.g., major theater war). Personnel needed to augment these AOCs should be organized as a permanent unit, ready to deploy forward, and trained and equipped to help their commander discharge Air Force, Joint, and coalition duties [such as being assigned as the Joint Force Air Component Commander (JFACC) or the Combined Force Air Component Commander (CFACC)].

This paper will describe the training, preparation, and capabilities that the command and control units constituting AOCs need in order to employ aerospace forces to their greatest effect before and during theater combat operations[2]. Throughout, we have used the public statements of top DoD, Joint, and Air Force decisionmakers as major information sources because they represent the people that these command and control units will ultimately serve. More detailed research is necessary to establish modernization priorities and to choose among alternative approaches. Here, we will focus on three major activities: Organizing and training command and control units; transitioning from peacetime to theater operations; and executing contingency operations. We will then briefly discuss important considerations in the development of new systems, procedures, and doctrine to support the command and control units within AOCs.

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[1]In Korea, the operations center is called the "Hardened Tactical Air Command Center." Operations centers for combined operations are called Combined Aerospace Operations Centers or CAOCs. The USAF is evolving Air Operations Centers into Aerospace Operations Centers. Our discussion here focuses on air operations, although many of our points are relevant also to space and information operations.

[2]The AOC is the senior component of the Theater Air Control System (TAC). Other command and control units of the TACS include Wing Operations Centers, Control Reporting Center, AWACS, JSTARS, ABCCC, and Tactical Air Control Party. We will not focus upon them here.

2. ORGANIZING AND TRAINING THEATER COMMAND AND CONTROL UNITS

The U.S. Air Force says that it will be effective and ready by sustaining its core competencies and the command and control through which those competencies are employed.[3] Effective and ready command and control units must be organized and trained for a variety of theater contingencies well before they occur, and be prepared to fight with allies and coalition partners. In addition, they must have current intelligence on the operational environment and potential enemies, and must have preliminary plans developed for contemplated contingencies.

Having effective and efficient air operations from the start of a contingency requires a well-established organization and extensive training for the commander and his staff.

The senior warfighting echelon of the U.S. Air Force is the Numbered Air Force (NAF), which conducts contingency operations with assigned and attached units. The Air Force tasks the NAF to present designated Air Force assets to the Joint Task Force Commander, who normally exercises operational control of these forces through the Commander, Air Force Forces (COMAFFOR). The NAF or the Expeditionary Aerospace Force commanders can be designated as the COMAFFOR. When the NAF commander is the COMAFFOR, his staff is organized into an Aerospace Operations Center (AOC), which provides the commander with the capabilities needed to plan, direct, and coordinate theater air operations.[4] The AOC operates as a command and control unit to support the commander and his immediate staff.

The baseline AOC consist of five divisions responsible for strategy, plans, operations, mobility, and intelligence, surveillance, and reconnaissance (ISR) (see Figure 1). However, the AOC does not exist in this fashion in peacetime. In peacetime, the NAF commander and his staff typically perform administrative and training activities that

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[3]See Ryan and Peters (2000).

[4]See United States Air Force, June 1 1999. We note that a major revision of this document is in progress.

bear little resemblance to their combat functions, and they are much smaller than the number needed for contingencies.

Strategy Division - develops, refines, disseminates, and assesses the progress of the commander's aerospace strategy

Combat Plans Division - drafts the joint air operations plan to support the JFC's campaign or objectives and builds the daily joint air tasking order (ATO)

Combat Operations Division - closely follows the action of current joint air operations, shifts their missions from their scheduled times or targets, and makes other adjustments as the situation requires

Air Mobility Division - plans, coordinates, tasks, and executes the air mobility mission

Intelligence element - monitors and assesses adversary capabilities and intentions; assists in target, weapon, and platform selection; conducts battle damage assessment; and provides status and priority of assigned targets to help allocate aerospace forces to tasks

New Instruction (but still in draft)

Intelligence, Surveillance, and Reconnaissance (ISR) Division is focused on providing combat ISR to aerospace planning, execution and assessment activities of the AOC. It assists the strategy division in developing the overall JFACC strategy; provides the combat plans division with tailored collection planning, threat analysis, and targeting expertise to develop execution plans for aerospace operations; provides the combat operations division current situational awareness, targeting, and ISR battle management for execution of the ATO; and helps the air mobility division apply ISR information and products to its missions.

Figure 1. Typical AOC Divisions and Elements

General John Jumper, Commander of Air Combat Command and recently Commander of United States Air Forces in Europe, observed that these peacetime activities do not adequately prepare the NAF commander for contingency operations.[5] The staff assigned to the commander has a

[5]General Jumper stated that "The Air Force does a poor job of training its top leaders, and needs to do a better job of training its senior officers to command at the operational level. Lieutenant General Mike Short (who was both the Operation Allied Force Joint Force Air Component Commander [JFACC] and the Combined Forces Air Component Commander [CFACC])… and most of the Air Force leadership trained ourselves because our system did not train us." From Tirpak (2000).

similar lack of preparation for contingency command and control. Typically, it is a "pick-up" team with between 20 percent and 50 percent of the operators in an Air Operations Center being permanently assigned and the remainder being supplied by augmentees. These augmentees may not have prior experience in the processes in place within an Air Operations Center and may take weeks to learn them at the same time that they are expected to develop alternative courses of action and build the first ATOs.[6]

For example, in Operation Allied Force (OAF) the theater command structure evolved from mid-1998 until military operations began in March 1999. The DoD described the initial Combined Air Operations Center (CAOC) in Vicenza, Italy, as "a hodgepodge of unique systems".[7] Over the course of Operation Allied Force, the personnel assigned to the CAOC increased from 400 to more than 1300. After the conflict, the DoD observed that, "Future conflicts will continue to require appropriate command-and-control centers to effectively execute and manage the joint force commander's strategy and execution plans. To be most effective, such centers cannot be set up from scratch."[8]

The CAOC was not, strictly speaking, set up from scratch since at least some systems and personnel existed in that location for the earlier Bosnia operations. And it is not clear that all of the 1300 people, most of whom were added to the CAOC over the course of OAF, were essential to the operation. However, new functions were instituted within the CAOC over time to more effectively deal with such things as enemy air defenses and ground forces. Ad hoc procedures were also developed to task allied forces and to integrate U.S. and allied operations (more about this later).[9] It took time to develop these new functions and procedures and to bring in and train the personnel needed.

General Jumper has stated that the USAF should treat the Air Operations Center as a weapon system. This means that block versions of the AOC systems would be defined and improvements made on a scheduled

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[6]From Tirpak (2000).

[7]See Department of Defense (2000).

[8]Ibid.

[9]The latter was particularly important because of the secrecy associated with U.S. stealth aircraft operations.

basis. Classifying the AOC as a weapon system might have an even greater consequence – the establishment of a permanent command and control unit to man it. The AOC operators would practice control of aerospace forces during training, perhaps during an Aerospace Expeditionary Force (AEF) work-up and vulnerability phase, and be prepared to transition to combat operations at a moment's notice. Rather than reconstituting the AOC command and control unit when conflicts erupted, the AOC would be constantly manned with personnel trained for the range of possible contingencies. The commander and his staff should be certified as part of this AOC unit, and be able to pass the same sorts of operational inspections to which other combat and supporting units are subjected.

The point is to train as you plan to fight. Theater operations are large and complex – the Air Force needs to devote a first-class team to these operations and exercise them on a continuous basis. Treating the Air Operations Center as a weapon system is a good first step in achieving this goal but additional steps will be needed.

Doctrine and systems must allow our operations to be integrated to varying degrees with allies or coalition partners.

Operation Allied Force involved aircraft from 14 NATO nations and used command structures that had not previously planned and conducted sustained combat operations. The U.S. Department of Defense stated that NATO's command structure worked well, but that parallel U.S. and NATO structures ultimately complicated planning and unity of command.[10] Lieutenant General Short, the Operational Allied Force JFACC, observed that he had "failed miserably" at building a coalition command structure – making the air war team leadership almost entirely American and displacing an Alliance command structure in place for 50 years.[11]

Since the United States is likely to have allies or coalition partners in any future conflict, our command and control concepts must be designed with the idea of plugging in allied and coalition partners. We should plan for alternative degrees of integration between U.S. and allied or coalition operations. The choices range from assigning

[10]See Department of Defense (2000).

[11]See Tirpak (2000).

different operational areas or tasks to U.S. and allied forces, to forming a combined command and control staff and carefully synchronizing U.S. and allied combat operations. The depth of integration desirable will depend on the convergence of strategic interests of the nations involved and the operational advantages that integration may bring. The depth of integration achievable will depend on the systems and doctrine used by each nation.

Ultimately, differences in the pace and direction of new system acquisition may be too great to achieve integrated operations at a technical level between the United States and our allies. It is even more important, then, to plan our command and control procedures to allow effective cooperation with allies or coalition partners who own dissimilar equipment and may have very different doctrine and abilities. Where U.S. and allied aircraft cannot be integrated into the same strike packages, U.S. command and control systems need to coordinate separate strikes on enemy targets to ensure effective and efficient force use with the least chance of fratricide. Anecdotal information from Operation Allied Force suggests that U.S. and allied operations were coordinated well enough to result in some number of successful strikes against Serbian targets.

Command and control units need timely, accurate, comprehensive intelligence for their area of operations well before contingencies in order to train and to develop plans.

The USAF intends to continue to enhance its reach and flexibility to "achieve desired effects from whatever range we choose" including striking "directly from the United States, or from regional bases."[12] Therefore, the commander and his staff must prepare for a variety of contingencies and may be tasked to provide aerospace power when needed on multiple continents and within many different theaters. This will require several distinct types of accurate and recent intelligence.

First, command and control units will need intelligence on the leadership, military forces, and war-supporting infrastructure of potentially hostile nations. "Static" intelligence concerning the types

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[12]See United States Air Force (2000).

and numbers of combat systems and forces possessed by hostile nations is certainly necessary but not sufficient. Also needed is knowledge of an enemy's operating patterns – how the enemy employs its forces, where those forces typically operate, and which events may signal the deployment or employment of especially critical forces. This information will help the commander and his staff to assess alternative enemy courses of action and whether U.S. tactics and strategies are likely to work. It will provide information that the United States can use to deter or influence potential enemies, or to shape the course of the conflict. Collection and analysis of this information requires varying levels of command and control over the surveillance and reconnaissance assets used.[13] Collection must be planned ahead of time and must reflect adjudication of the needs of many different users.

In addition, command and control units will need accurate and reliable information on ports and airfields that might serve as points of debarkation and operating bases. Agreements with host nations concerning the deployment and operations of forces in their countries must be in hand. Finally, the commander and his staff will need topographical, meteorological, and other data on the operating environment.

It is difficult to gather and update this information for even one potential theater; to do so regularly for several potential theaters will be especially difficult. Once the information is collected, the command and control systems and processes supporting the commander and his staff must actively "pull" (or "subscribe") information from military and national intelligence sources and push (or "publish") the appropriate information to combat units. The systems and processes must help gather, sort, and maintain this information and update it continuously. The information must then be made accessible to the theater forces and their command and control structure at every level.

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[13]It also requires some ability to set priorities for the associated processing, exploitation, and dissemination of the resulting intelligence products.

Contingencies are likely to develop rapidly — placing a premium on prior planning and the ability of the commander and his staff to adapt plans rapidly.

Before the Iraqi invasion of Kuwait, no detailed plans existed for the defense of Saudi Arabia. Although preliminary aspects of planning for operations in the region had been underway since the spring of 1990, detailed planning for the deployment of forces had only just begun when Iraq attacked. Lieutenant General Chuck Horner, the COMAFFOR for United States Central Command, and his staff began planning an air campaign the day after the invasion. Even with augmentation by planners from the Air Staff a few days later, it took a month of concerted effort to develop a plan that reflected the agreed objectives with sufficient resources to carry it out. The final plan was updated and modified to reflect targets added to the list (from 84 to more than 300 by January 1991) and took several more months to prepare.[14]

An observation from the war was that the U.S. military needed to review its planning for contingencies, make sure that plans are devised that enable it to adapt to unforeseen contingencies as quickly as possible, and ensure that a staff exists that is experienced in generating these plans. The Department of Defense stated that "training must emphasize the speed with which these types of plans must be drawn up, as that is likely to be vital in an actual crisis … planning systems must increasingly adapt rapidly to changing situations, with forces tailored to meet unexpected contingencies."[15]

Although all the details of operational plans cannot be developed beforehand, much general planning can be accomplished for contemplated contingencies. The National Security Strategy identifies regions in which the United States has vital or important interests and identifies threats to those interests. Long before a crisis occurs, the commander and his staff can identify hostile forces — including those that pose especially difficult operational challenges — and can develop alternative courses of action for a range of plausible contingencies. The act of planning provides experience for the commander and his staff,

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[14]See Winnefeld et al. (1994).

[15]See Department of Defense (1992).

and can provide essential knowledge for more detailed planning should the contemplated contingency occur in some fashion.

Command and control systems and procedures must help the cognizant NAF commander and his staff generate preliminary plans and update them as new information is gathered, capabilities of U.S. or hostile forces change, or the U.S. mission changes. As a contingency develops, the command and control systems must help the commander develop detailed deployment and execution plans and direct combat operations in a theater as the first combat forces arrive. To fight an effective campaign from the very beginning, the commander and his staff must have the tools available to synthesize campaign strategies as they simultaneously conduct operations. The commander and his staff must be able to change these plans rapidly and re-task forces as the results of previous attacks are assessed, the enemy changes his strategy, or opportunities arise to achieve a decisive advantage.

3. TRANSITIONING FROM PEACETIME OPERATIONS TO THEATER OPERATIONS

Once theater operations begin, the top commander for each contingency will determine how deployed forces will be commanded — including who will command aerospace forces. In some contingencies, the Air Force commander may not have forces in the theater and may have to employ aerospace power from outside the theater. These forces must be capable of conducting operations immediately upon entry to the theater. Transitioning to theater operations will typically require the deployment of aerospace forces, which in turn will require an enormous amount of planning by the Air Force commander and his staff.

Force deployments require detailed plans and the implementation of many agreements with host nations. Command and control personnel can speed this deployment by maintaining information on the theater infrastructure and by identifying the agreements needed.

Air forces will, in the future, be tasked to conduct combat and other military operations upon short notice, in distant theaters, and with minimal preparations for sustaining operations. The commander and his staff will be expected to be ready to conduct operations at any time, to be quick to deploy, and to be at maximum effectiveness on the first day of a conflict. As one example, General Zinni, former Commander-in-Chief of U.S. Central Command (CENTCOM), made the following comments regarding aerospace forces:

> It has been hard to convince some that forces do not have to be immediately at hand, but simply available, to meet the mission. Our ability to deploy and get to the scene . . . in a short time and [to] meet the requirement has been demonstrated both in the Balkans and the Middle East. We demand for you to be expeditionary now, to build very bare-based environments, to do this on a short term. This has required significant change in our entire approach. [16]

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[16]From Tirpak (2000).

During the Persian Gulf war, the USAF deployed over 1400 aircraft and all of the weapons and supporting equipment needed to conduct a major theater war. Much planning, information gathering, and coordination was needed to execute this deployment. Then Secretary of Defense Dick Cheney noted that, "We benefited greatly from . . . the long interval to deploy and prepare our forces that we cannot count on in the future."[17] Ultimately, it took six months to deploy the forces needed to defeat Iraq and, luckily, the Iraqi leadership made that time available.

In Operation Allied Force, arrival of some forces was delayed and the DoD identified inadequate planning systems and poor planning discipline as major factors in the delay.[18] The DoD termed these failures avoidable, and concluded that it needed to improve its ability to plan and execute military deployments by taking several actions.

Delays in force arrivals in OAF did not necessarily result in a less-desirable outcome. Sufficient forces were available throughout the conflict to strike the approved targets. The main point, however, was not whether the pace of force deployments was sufficient for OAF, but whether the deployments could be speeded up to achieve a better outcome in some future conflict. To this end, several DoD conclusions regarding OAF are instructive.

First, DoD concluded that a deployment checklist should be included in our international agreements to ensure critical host nation support. This checklist would include items such as designated points of entry and departure, overflight rights, use of radio frequencies, air traffic control, blanket diplomatic clearances, basing rights, facility access agreements, force protection, and site surveys, to name several. To ensure the availability of aerial refueling, DoD determined that a real-time, in-theater planning process is needed. Finally, DoD determined that the personnel generating Time-phased Force Deployment Lists must receive continuous training to maintain the skills needed to plan contingency deployments.

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[17]See Department of Defense (1992).

[18]See Department of Defense (2000).

The ability to rapidly reposition forces requires that the theater Air Force commander and his staff continuously update deployment plans to ensure that the necessary host nation agreements are in place and to keep their planning skills and tools sharp.[19] The commander and his staff also need the ability to assess the impact of a major force deployment on the ability of the United States to respond should another conflict erupt. Theater command and control systems should provide in-transit visibility of deploying forces to track the status and location of those forces needed for major theater wars. Once a contingency has begun, theater command and control forces must be operational before entering the theater in order to participate in deployment planning and to conduct combat operations with the first forces to arrive.

To have forces that can rapidly position themselves "in any environment, anywhere in the world," the Air Force has developed the Air Expeditionary Force (AEF) concept.[20] The AEF is designed to provide ready force packages that can be tailored to meet the needs of a given contingency; they may, however, pose unique command and control challenges. The Air Force plans for AEFs to either fit into established theater-based command and control structures or to quickly deploy their own expeditionary Air Operations Centers tailored to each contingency. However, the footprint of a current air operations center is huge, and requires the equivalent of three C-141 transport aircraft for the equipment alone.[21]

The size of the deployed command and control force could be reduced by performing some functions in CONUS (e.g., at a rear operations support center) or at permanent overseas bases. As the contingency develops, some of these functions could be moved into the theater as airlift becomes available and the situation allows. The CONUS-based functions could provide redundancy and continued operation if the in-

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[19]It the responsibility of the CINC to make the agreements with the host nation. The cognizant NAF commander, however, needs to track these agreements to ensure that they cover the rights, accesses, and other items needed.

[20]See USAF (2000).

[21]See Jumper (2000). Efforts are underway to reduce this footprint.

theater center is disabled. To remove functions from theater to rear-areas, the theater commanders must gain confidence that these functions can be performed remotely. Such confidence can come only from practice and experience.

The Joint Force Commander chooses how aerospace power will be commanded to support his campaign plan. The Air Force must ensure that its commanders can control aerospace operations in theater from the start of a contingency – even before forces have deployed to the theater.

Establishing a command structure is a prerequisite for conducting military operations. Current joint doctrine recognizes the need for "unity of effort, centralized planning, and decentralized execution."[22] Unity of command is achieved by appointing a Joint Force Commander (JFC), who may be the Combatant Command Commander-in-Chief (CINC) or a senior military officer reporting to the CINC. Decentralized execution is achieved by appointing subordinate commanders to plan, coordinate, and direct the forces assigned to the JFC. These subordinates may include Joint Force Land, Maritime, Air, or Special Operations commanders. For example, General Horner was designated the Joint Force Air Component Commander (JFACC) for Operations Desert Shield/Desert Storm.

However, the JFC is not obligated to assign a JFACC or any other component commanders. He may instead choose to plan, direct, and control the operations of assigned forces himself using his own staff. As an example, General Schwarzkopf did not appoint a Joint Force Land Component Commander in Operation Desert Storm – deciding to perform that function himself.[23] When he does assign a JFACC, the JFC is not obligated to assign the senior Air force officer as the JFACC, even when the Air Force provides the majority of aerospace forces.

The JFC is most likely to appoint a JFACC when the operation is complex. For example, General Horner and his staff had to plan and direct 980 daily sorties in Operation Desert Shield and more than 2800 sorties during Desert Storm. In addition, General Horner was assigned

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[22]See Chairman of the Joint Chiefs of Staff (1994).

[23]See Department of Defense (2000).

as the airspace control authority, interdiction coordinating authority, air defense commander, and as USCINCCENT (forward) in the early days of the deployment – obliging him to focus on the defense of Saudi Arabia and the deployment of forces to the theater before planning for offensive operations.[24]

The Air Force commander is best positioned to serve as the JFACC when he has an AOC ready and able to direct aerospace operations from the very beginning of the contingency. This means that there must be a command and control unit in an AOC monitoring any crisis into which U.S. forces may be sent. It does not mean that every Air Force theater commander needs to have a unit operating an AOC at all times. But he does need to have access to an AOC, preferably within the same Air Force Major Command, with a cadre monitoring crises in the regions to which he may be asked to send forces. The Air Force theater commander and his staff could fall-in upon that AOC when orders to commence operations appeared imminent, and the AOC could provide the initial control for aerospace forces sent into the theater. When needed, some portion of the AOC unit must be ready to deploy if the Air Force commander moves to the theater.

The AOC unit needs to be well integrated with other Air Force and Joint capabilities to help the Air Force theater commander execute all of the functions assigned him by the JFC. General Horner and his staff were able to execute the JFACC duties, in part, because they received "reach-back" support from other Air Force and Joint organizations in CONUS.[25] This particular arrangement was ad hoc, but could be developed into a well-established procedure to incorporate warfighting capabilities from all Air Force elements.

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[24]In these other roles General Horner and his staff had to control 122 refueling tracks, 660 restricted operating zones, 312 missile engagement zones, 78 strike corridors, 92 combat air patrol points, and 36 training areas. See Winnefeld et al. (1994).

[25]General Horner was able to receive deployment and other support from the Tactical Air Command (TAC) staff at Langley AFB, intelligence support through the Checkmate organization of the Air Staff, and other support from Joint organizations.

New forms of communications — such as video-teleconferencing — will be used by higher levels of command to keep track of contingency operations. The Air Force needs to take advantage of these capabilities and not become vulnerable to their potential misuse.

In Operation Allied Force, General Clark — the Supreme Commander of Allied Forces, Europe, and the Commander, U.S. European Command — used video-teleconferences (VTCs) to keep in touch with his subordinate commanders. Video-teleconferencing allowed senior leaders throughout the theater unprecedented visibility into the decisionmaking process and the real-time ability to exert influence over many aspects of the operation.[26] Advantages included the ability to shorten decision cycles and deliver clear and unambiguous orders, and the elimination of the need for key commanders to be co-located.

However, the video teleconferences could become a "voracious consumer of leadership and key staff working hours." Worse, they could lead to "misinterpretation as key guidance is filtered down to lower staff levels," particularly if that guidance was never translated into campaign plans and written orders.[27] Furthermore, VTCs gave the opportunity, and probably the temptation, for senior leadership to "sink to past comfort levels [rather than] remain at the appropriate level of engagement and command."[28]

Higher levels of command, including the National Command Authority (NCA) and the CINC, will want to monitor both enemy activities and U.S. operations to ensure that the campaign is having the desired political and military effects. Top national and military leaders are likely to demand greater quantity and quality of information as it becomes available within an AOC to increase their visibility into ongoing operations. However, better visibility into operations might also tempt higher command echelons to manage operational details — or substitute themselves for component commanders.

The key for the Air Force commander is to provide enough information to his superiors so that they are satisfied to "remain at

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[26]See Department of Defense (2000).
[27]See Ellis (2000).
[28]See Ellis (2000).

the appropriate level of command." The Air Force commander and his staff must also demonstrate that they are better able to make detailed aerospace power application decisions.

4. EXECUTING CONTINGENCY AIR OPERATIONS

Future Joint Force Commanders will expect greater flexibility and effectiveness from aerospace forces in killing both preplanned targets and high-value targets that emerge at unexpected times and places.[29] The Air Force promises "freedom from attack, freedom to maneuver and freedom to attack, while denying those to the enemy" even against capable defenses, at night, in bad weather, and in difficult terrain. The Air Force *Vision 2020* document promises "integrated aerospace capabilities" that will "provide the ability to find, fix, assess, track, target and engage anything of military significance, anywhere."[30] It is unclear to what degree this goal can be achieved by 2020. The Air Force clearly needs to improve, for example, its ability to attack time-sensitive targets and to quickly assess the results of attacks.

The Air Force commander and his staff will need to filter and integrate an unprecedented amount of information to best allocate and control sorties and assess their results— especially against time-sensitive targets.

Over the past decade, ISR support to military operations has improved, but further improvements are needed, especially for prosecuting time-sensitive targets. In Operation Desert Storm, the NCA and coalition commanders considered overall intelligence to be a qualified success and rated it as the best in any war up to that time.[31] However, difficulties in the translation of ISR information to target planning and attack assessment were noted by command and control personnel in-theater. For instance, locating and destroying mobile missiles proved very difficult and required substantially more resources

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[29]Gen Anthony C. Zinni, CINCCENT, "The success of airpower has set the bar too high for future operations. The expectations are so great now: zero casualties, perfect execution, completely flawless. However, the technology advances – precision ordnance, standoff weapon systems, increase in ISR capabilities, space-based systems, and what they give us in terms of accuracy, command and control, visibility of the battlefield mean we can do a lot more with fewer assets." From Tirpak (2000).

[30]See USAF (2000).

[31]See Department of Defense (1992).

than planned. Ultimately, it is unclear how many, if any, launch vehicles were destroyed. This could become a more serious problem in the future against an enemy who can deploy either more accurate missiles or weapons of mass destruction.

The lack of a tested, fully coordinated battle damage assessment (BDA) system was also a problem in Desert Storm.[32] Timely, accurate BDA is vital to ensure that each sortie is used to best effect and that people and equipment are not risked in needless restrikes. The weather, dynamics of the ATO, size of the target list, and numbers of aircraft involved degraded BDA collection, analysis, and dissemination. The ad hoc BDA system developed used both objective (physical evidence) and subjective (military judgment) analysis, but often did not result in a clear, coordinated process for determining whether targets, such as tanks, were killed by aircraft. This may have led to misreading of Iraqi force strength and perhaps unnecessary adjustments in targeting prioritization and sortie allocations.[33]

In Operation Allied Force, information collection was a high priority to provide a comprehensive view of the theater and to detect and track mobile targets. A variety of ISR sources were downlinked into the CAOC, where operators analyzed the information and used it to develop target lists and approve strikes. The DoD stated that the "overall quality and level of intelligence support provided during OAF was far superior to that provided during the Gulf War."[34] However, according to one senior officer, U.S. intelligence, surveillance, and reconnaissance turned out not to be very agile.[35] U.S. strike reaction times were slow, and the Serbs "frequently dispersed their air defenses and fielded forces from one location to another" making it "difficult for NATO to find, fix, and destroy them."

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[32]One planner noted that "a vast majority of the time targets were either attacked or not attacked appropriately – in spite of the established "system," not because of it. The planners, forced to improvise alternate means of feedback and targeting information, had already figured out target priorities and reattack requirements before the established system made its inputs." See Deptula (1993).

[33]See Department of Defense (1992).

[34]See Department of Defense (2000).

[35]See Jumper (2000).

The DoD observed that the current systems and processes "did not provide all of the support desired" and that better preparations for contingencies were needed.[36] In conclusion, DoD stated that, "improved policies, procedures, and tools are needed to further enhance the quality and responsiveness of precision intelligence support for military operations," especially for time-sensitive operations.

Providing the surveillance and reconnaissance information needed to spot concealed forces as the enemy employs them is a major challenge, and will require substantial investment by the Department of Defense. Killing time-sensitive targets requires precise target data with continuous updates to the shooter until the target is struck. Sensors with day, night, and adverse-weather capability are needed to locate, identify, and track mobile targets within short timelines despite enemy attempts at concealment and deception. These sensors must provide continuous coverage of the battlefield to ensure that critical mobile targets will be spotted and tracked. It is unclear at present what systems and platforms will provide these capabilities.

Dealing with the vast amount of data that future sensor systems will provide will also be a significant challenge. Some of the data will need a lot of processing to extract the desired information, reducing the volume of data that the commander or his staff sees but with a time delay. Some of the data may be fed directly into the commander's AOC, which will help to improve timeliness but will also increase the processing burden on the commander and his staff. The command and control systems and procedures must help them extract the knowledge they need from the vast amount of information future systems are expected to provide.

The command and control systems must help the commander and his staff interpret greater quantities of information to achieve improved operational effectiveness.

Ultimately, greater quantities of information help the commander and his staff only if that information can be used to improve operational effectiveness. The commander must be able to shift the

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[36]See Department of Defense (2000).

weight of his attacks against newly emerging or higher-value targets as needs warrant. The command and control system must help the commander and his staff quickly form a coherent picture of the battle, and determine which aircraft and weapons can effectively strike emerging targets while minimizing the loss of their use against previously planned targets.

To do so, the commander and his staff need command and control systems that allow them to focus on planning strategy and controlling forces rather than assimilating and processing data. Lieutenant General Michael Short noted that data from the various sensors are not shared or combined to build a recognizable picture of the operation.[37] That is, there is no automated process to build a complete and understandable view of friendly and enemy force identities, positions, and status. General Jumper commented that the commander and his staff build that picture in their minds from the many pieces of data that they receive from many sources. Too much information will swamp their ability to use it productively, while intermittent data can yield only scattered snapshots of the battle.[38]

The commander and his staff need systems that collect and display information that is "decision quality" – that is complete and understandable enough to allow rapid assimilation in order to allow them to make decisions. To conserve their time and attention on the processing end, they need systems that can automatically build an air tasking order and help optimize force allocation decisions. To increase their ability to strike elusive targets, they need control and communications systems that enable them to reallocate aircraft and weapons to new targets while those aircraft and weapons are en route. Finally, the commander and his staff need to automatically receive assessments of the effects of their strikes.

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[37]See Grossman (2000).

[38]General Jumper, "Today, we focus on the data to the point where the only fusion that takes place is between the ears of the JFACC and a few of the folks out there on the floor. And most of the stovepipes are just providing data – flooding you with either e-mails, pieces of paper in the inbox, or more stickies on the map." See Jumper (2000).

Automation will not satisfy all of the commander's information needs. The commander and his staff must add to this information through certain key decisions, such as deciding which contacts are hostile. It will take continuing effort and training to determine which information is most important to the commander during a contingency, and how it should be presented. This effort and training must begin long before deployment to a contingency. The systems supporting command and control must also be flexible enough for the commander and his staff to adapt them as circumstances or needs dictate.

5. IMPLICATIONS OF DESIRED COMMAND AND CONTROL CAPABILITIES FOR THE DEVELOPMENT OF SYSTEMS AND PROCEDURES

The capabilities discussed in this paper will be realized by organizing dedicated command and control units with the training and doctrine needed to command aerospace forces in a range of contemplated contingencies. These command and control units must be equipped with the systems and procedures that they need to execute their missions and tasks. Some attributes and capabilities desired in these systems and procedures have been noted already. We now mention some of the implications of the desired command and control capabilities on the *process* by which these systems and procedures should be developed.

First, command and control systems and procedures should be designed as part of a comprehensive command and control concept. This concept will include which functions will be conducted within a deployed AOC and which will be conducted at permanent sites in CONUS or overseas. The concept will include which decisions will be reserved by higher levels of command, which can be made by the theater Air Force commander, and which can be delegated to forces in the field.

Second, command and control system and procedures must be useful for the various training tasks, including the planning and control of training flights, planning for simulations and exercises, and command and control of forces in exercises and experiments. The commander and his staff will increase their skill and comfort with these systems and procedures by using them in a training environment before deployment to a contingency. Limitations or problems can then be readily spotted and corrected before such deployments.

Third, the command and control systems and procedures must allow and facilitate a continuous process of upgrades and improvements. Some improvements will originate within an Air Force or contractor laboratory. These must be subjected to trial and scrutiny by the command and control staff and modified as needed. Other improvements will begin as user applications developed by the command and control staff themselves to help them perform their duties during training or

contingencies. These should be tested to ensure that they will not harm other functions of the system. The development and fielding of improvements might take place in several phases, including initial development, test and evaluation, fielding and training, and use in an actual contingency. These activities might be performed at the same or different sites, so long as they proceed as quickly as possible but not damage the ability of existing systems to conduct operations. (This point is not specifically tied to any of the italicized points or discussions earlier in this paper.)

Finally, the command and control systems and procedures must be thoroughly evaluated and practiced by the commander and his staff in order to understand their "handling qualities." Most of this evaluation and practice should be in a joint context, and at least a significant portion should be in a coalition environment. As the commander and his staff automate processes and shorten decision and reaction times, the complexity of the system and the potential for cross-coupling of its elements will increase. As the command and control system becomes more complex, and elements of the system become more closely coupled, the opportunity for potential vulnerabilities and undesirable characteristics will rise. If a clever adversary can spot patterns in the behavior of theater command and control decisions, he may find ways to exploit them, perhaps by timing the use of his forces to avoid (or engage) U.S. forces in ways most advantageous to him.

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